

TITLE: METHOD OF INFERRING ROTORCRAFT GROSS WEIGHT

Inventors: Timothy D. Flynn, et al.

Filed: February 13, 2004

BFM-02501

Agent: Anne E. Saturnelli

Reg. No.: 41,290

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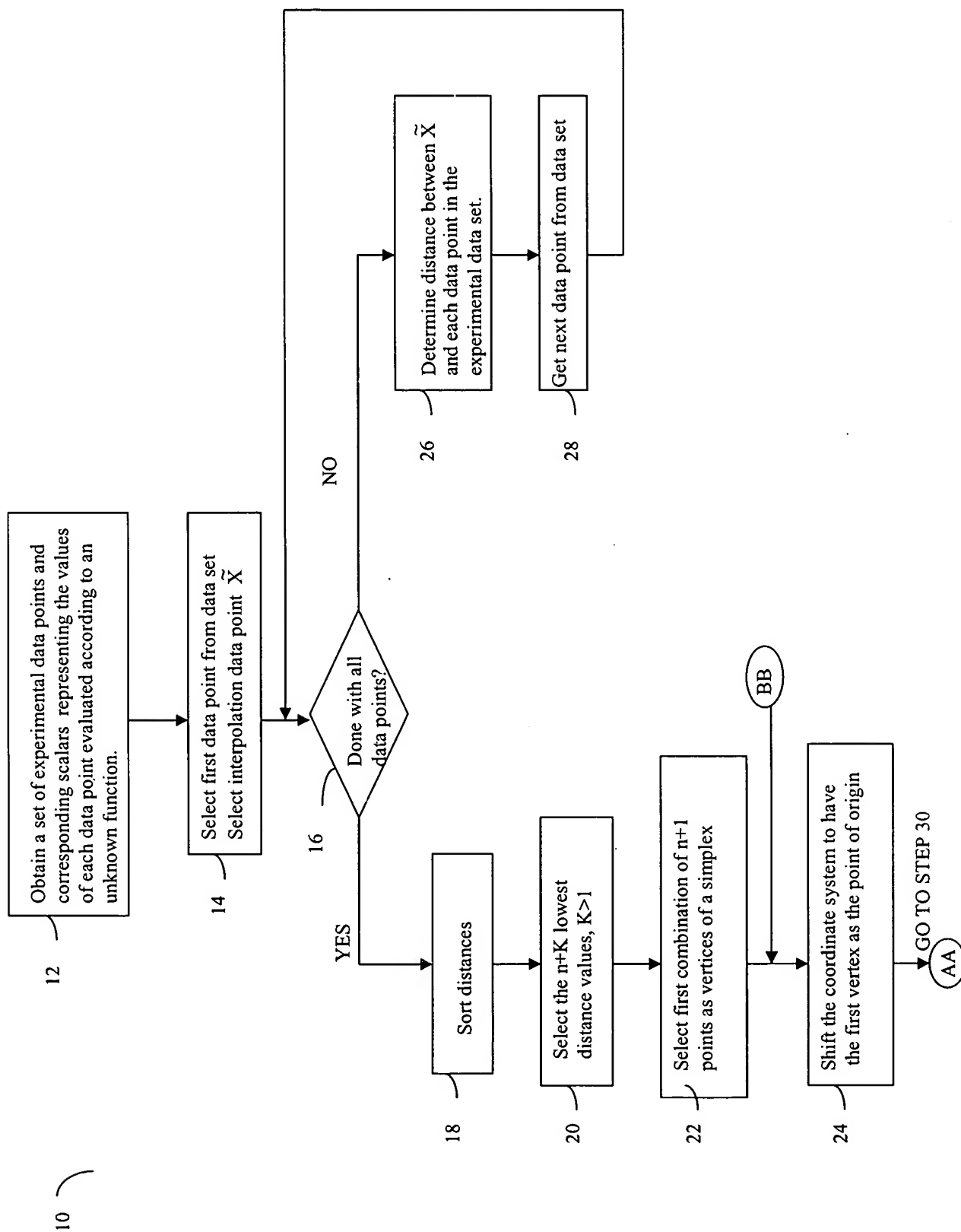


FIGURE 1

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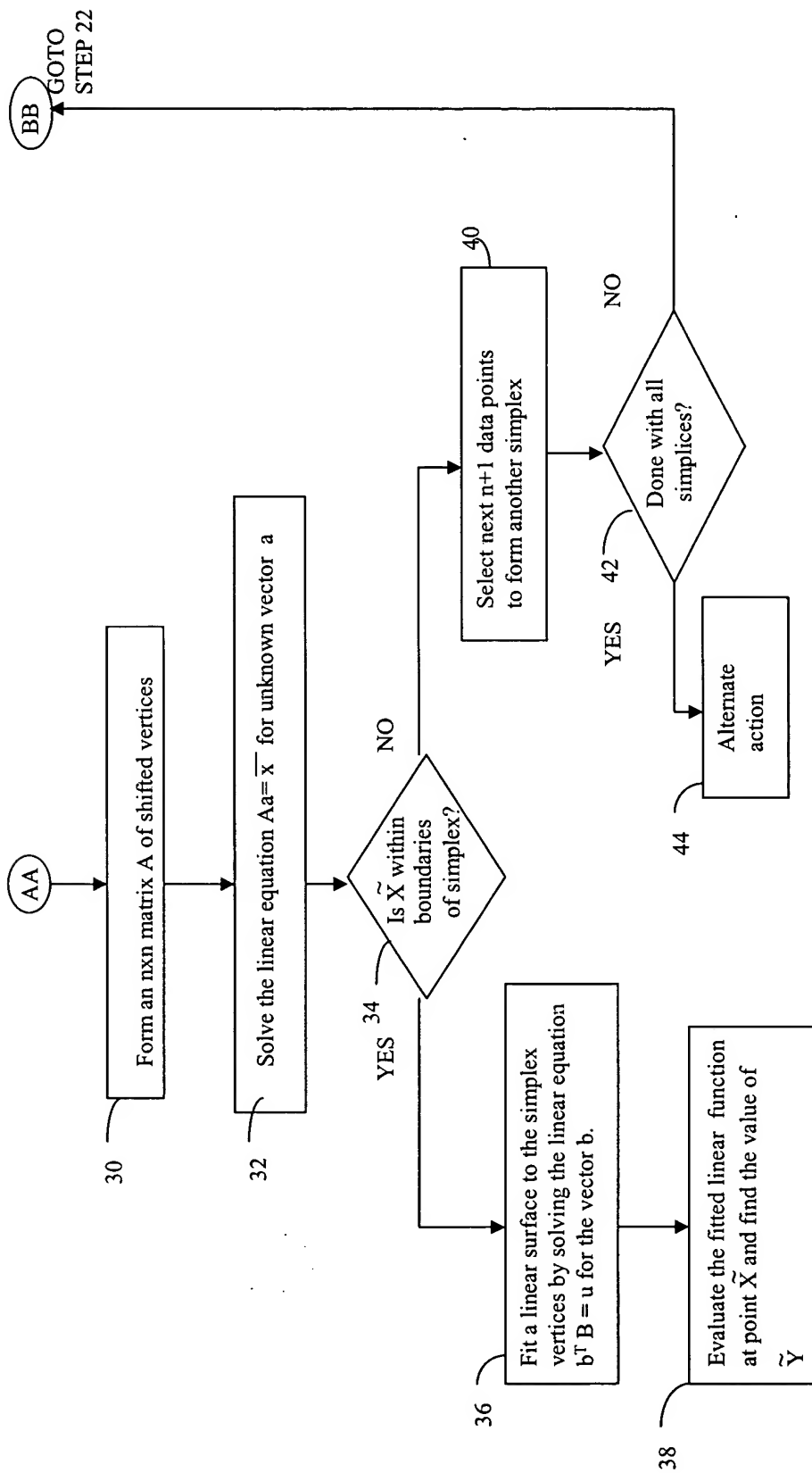


FIGURE 2

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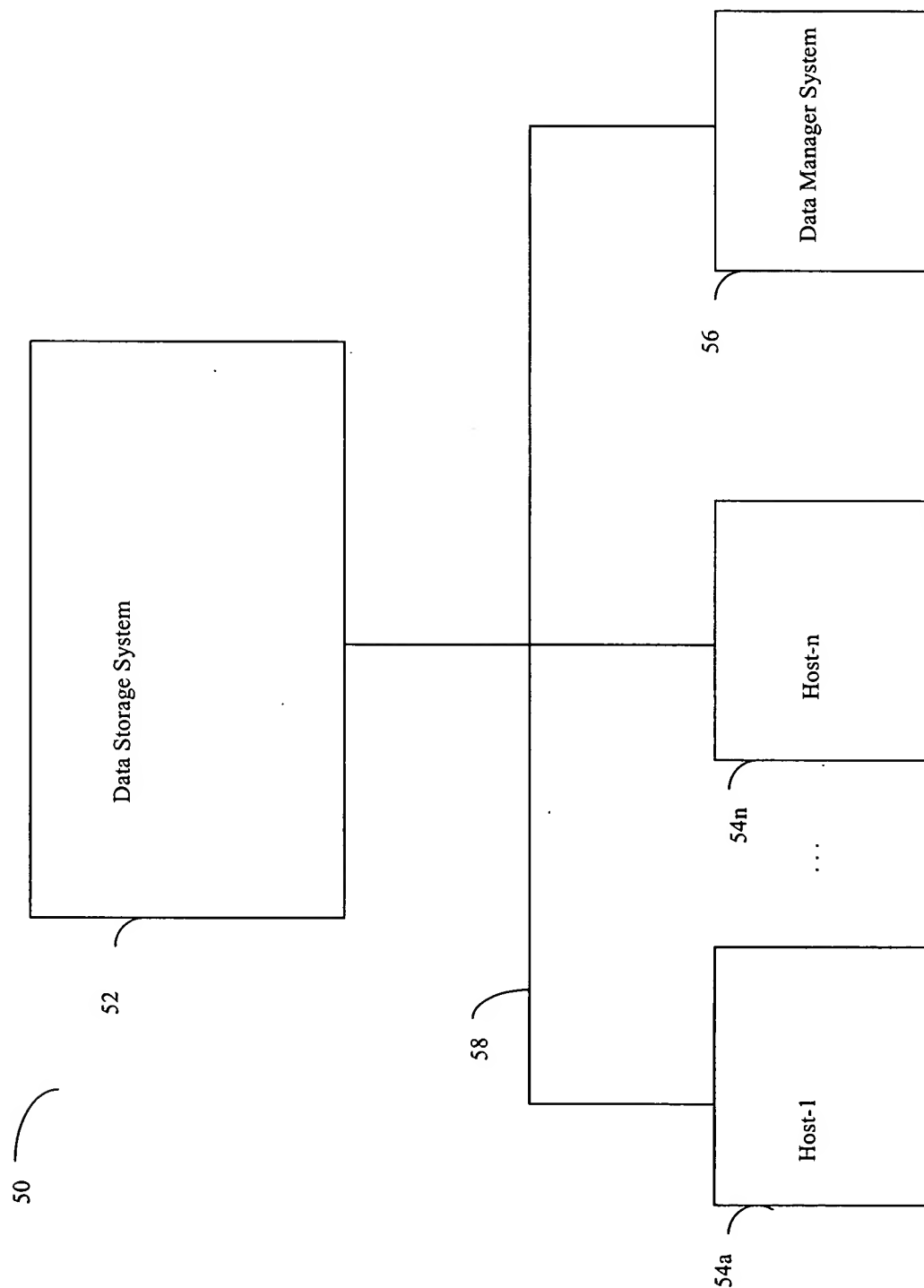


FIGURE 3

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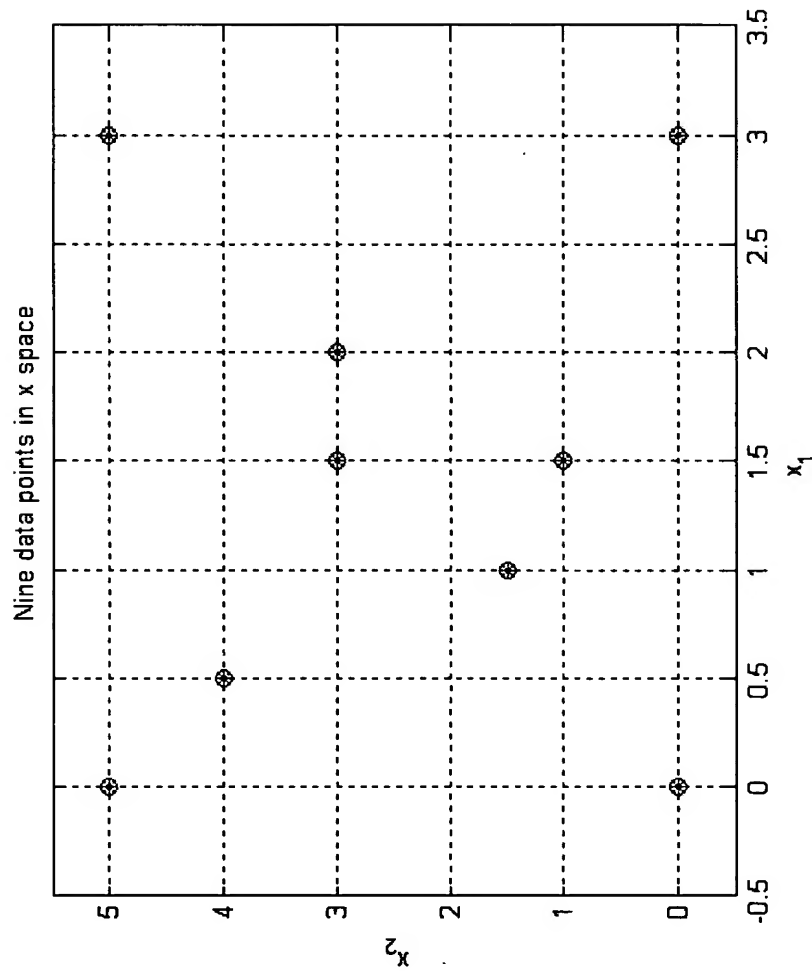


FIGURE 4

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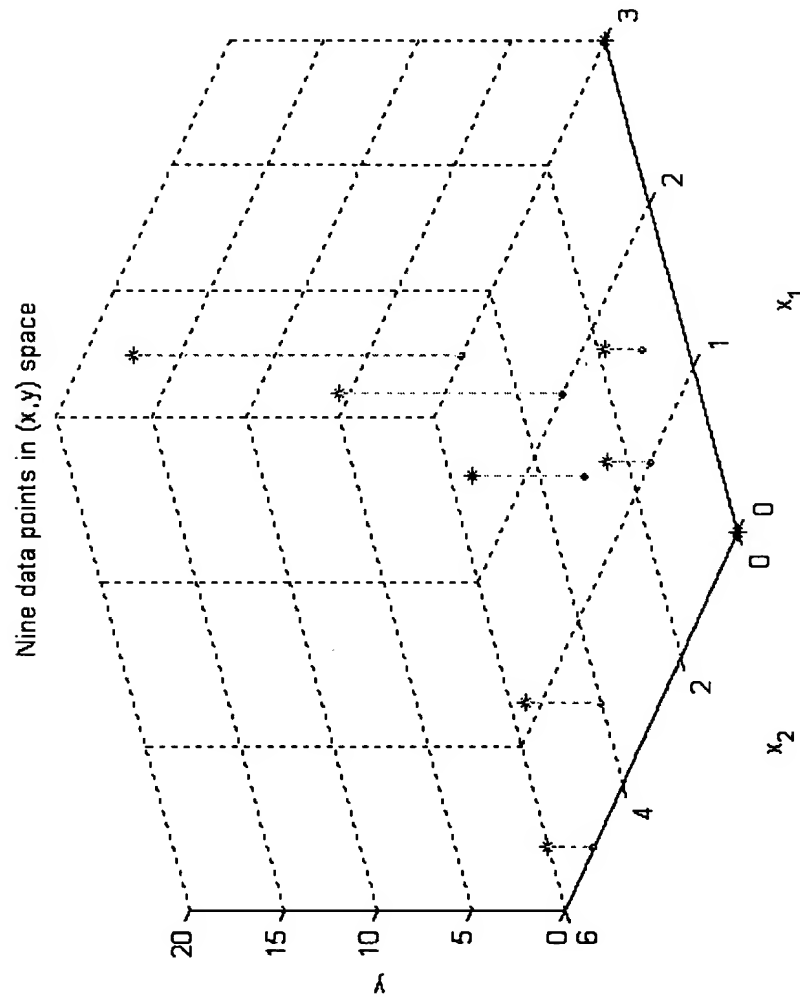


FIGURE 5

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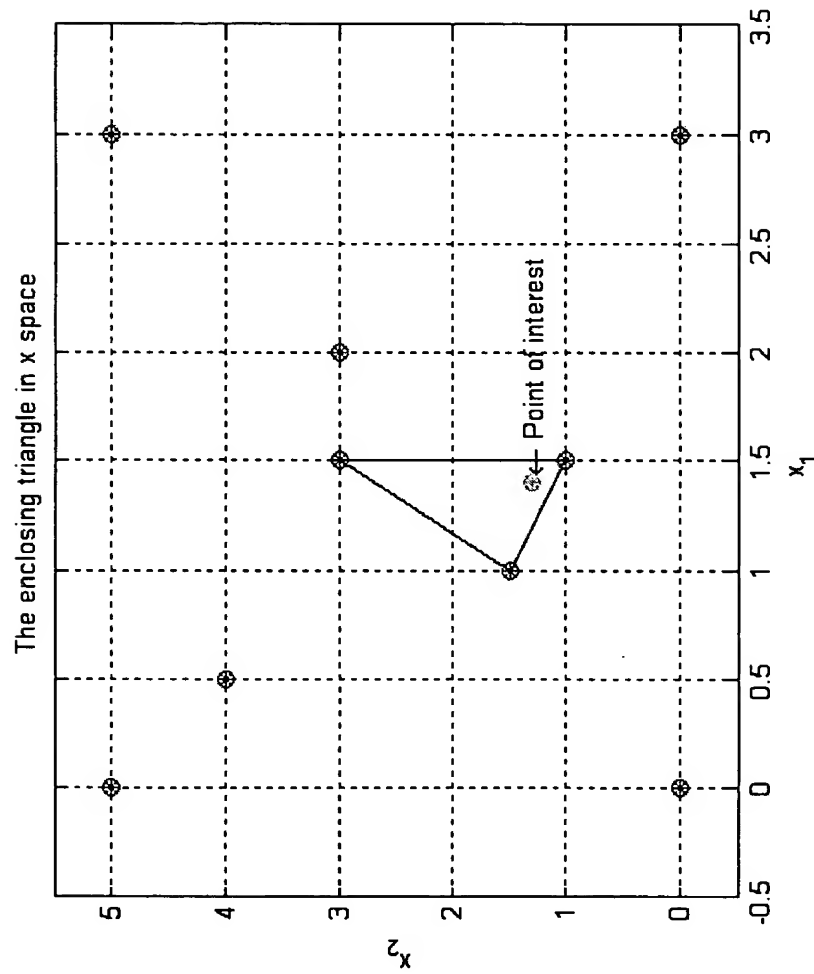


FIGURE 6

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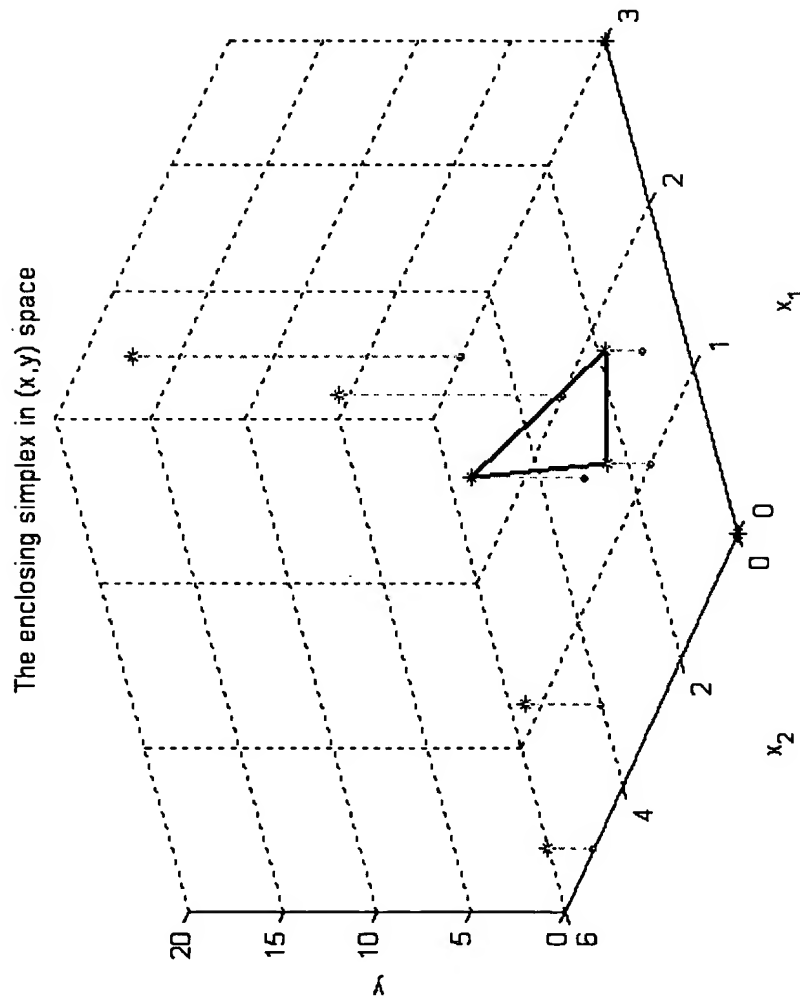


FIGURE 7

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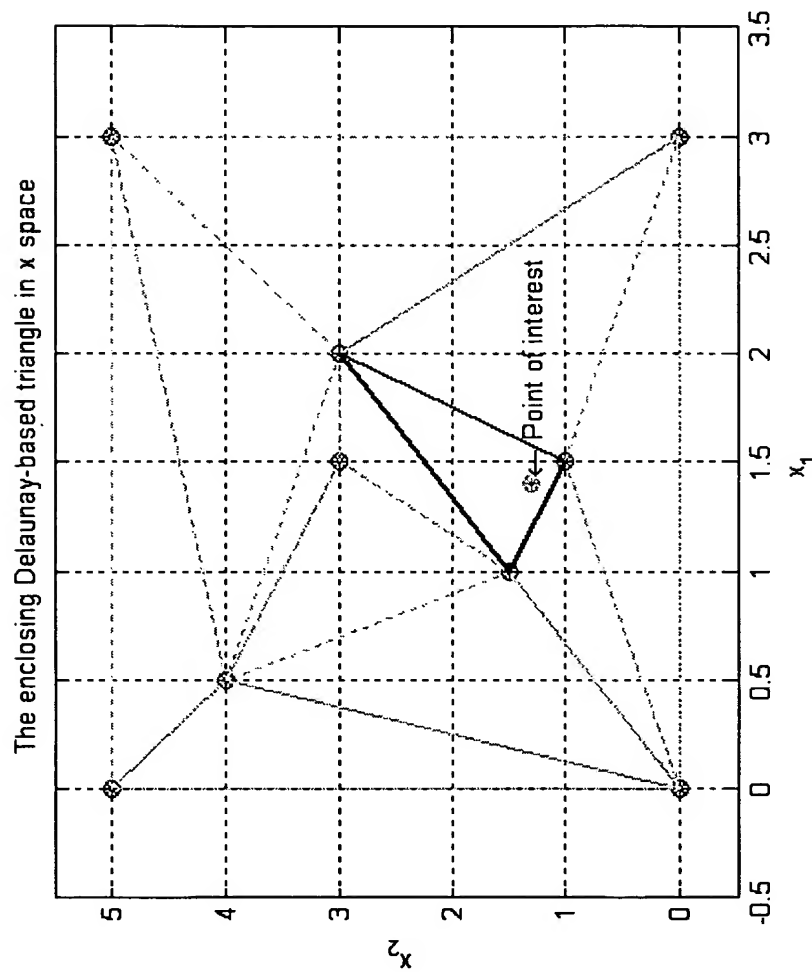


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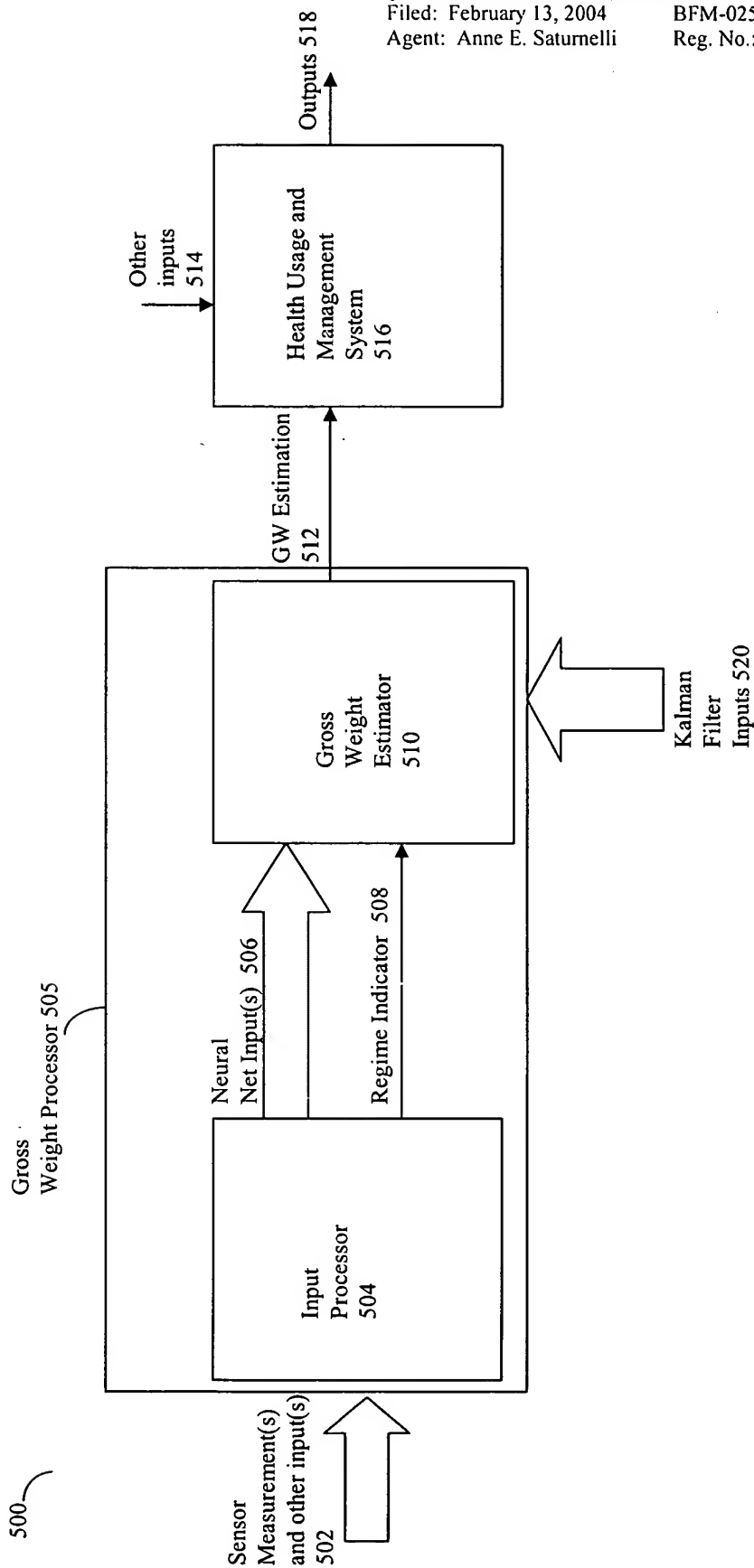


FIGURE 9

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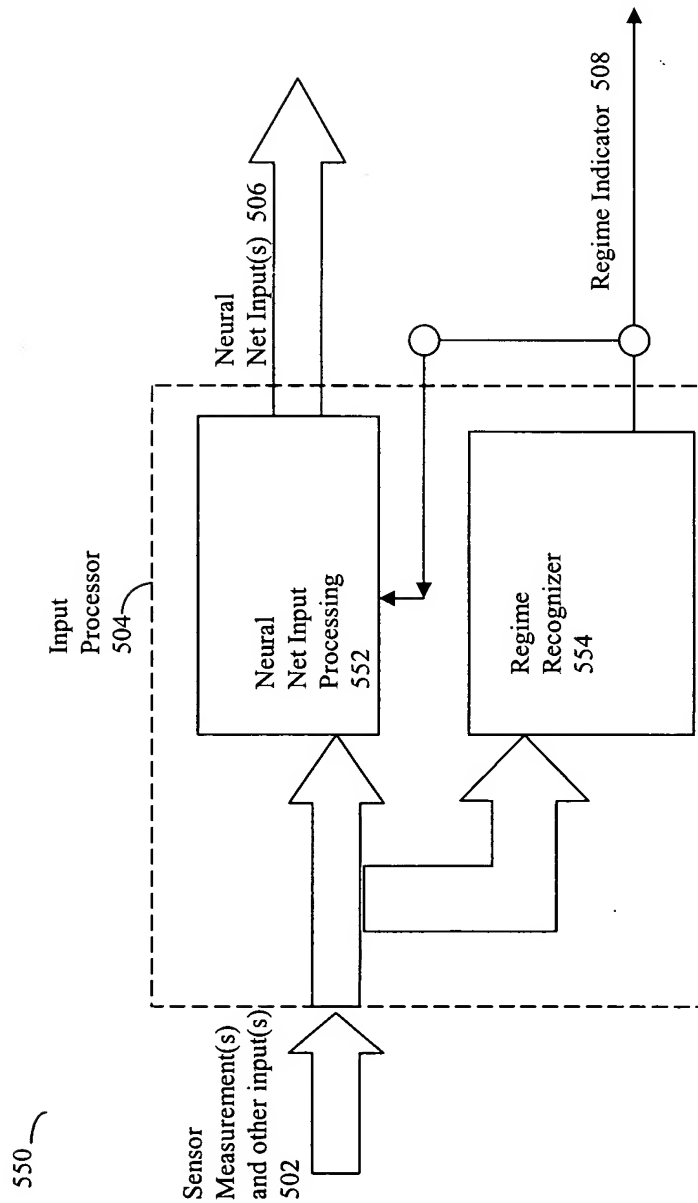


FIGURE 10

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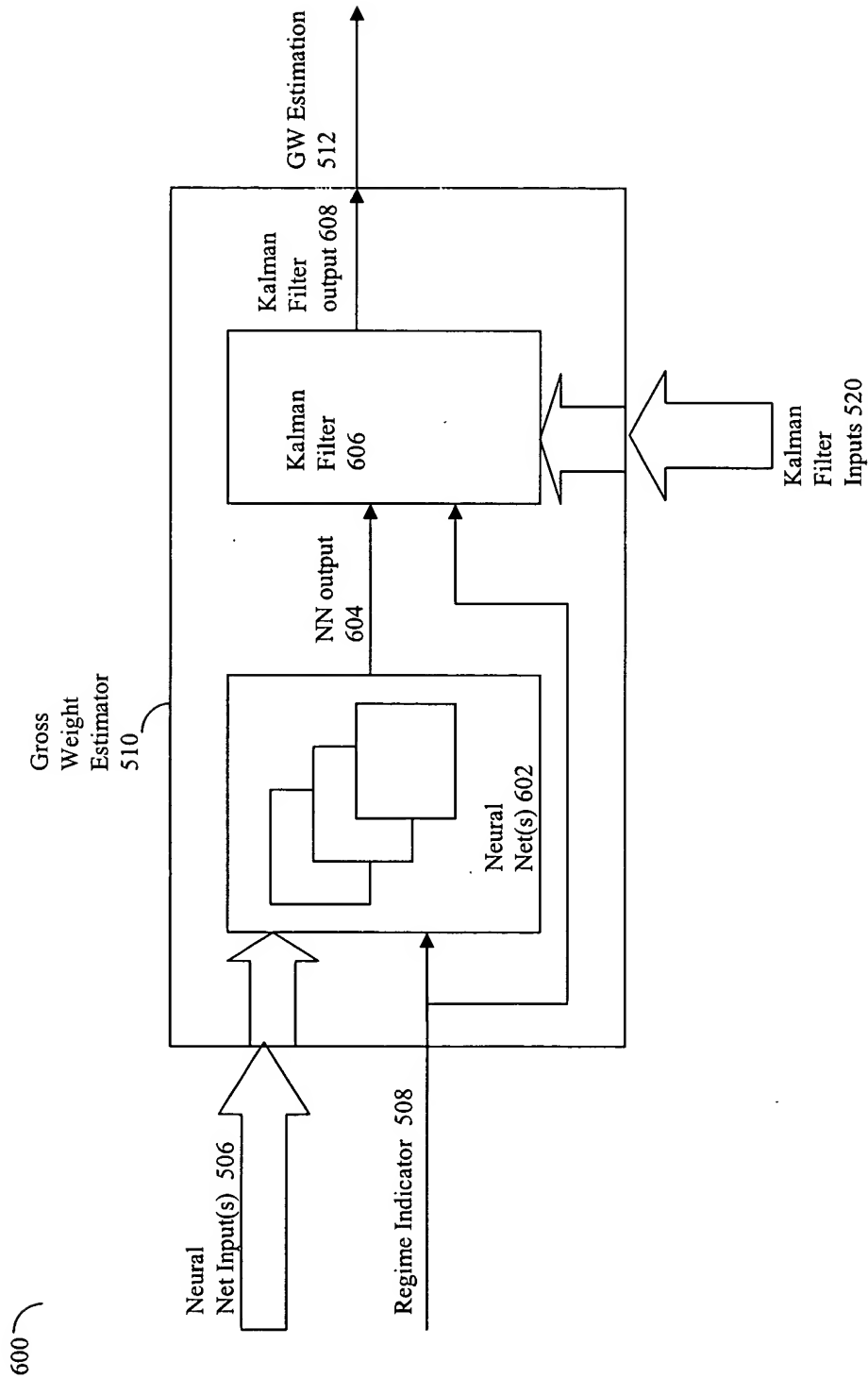


FIGURE 11

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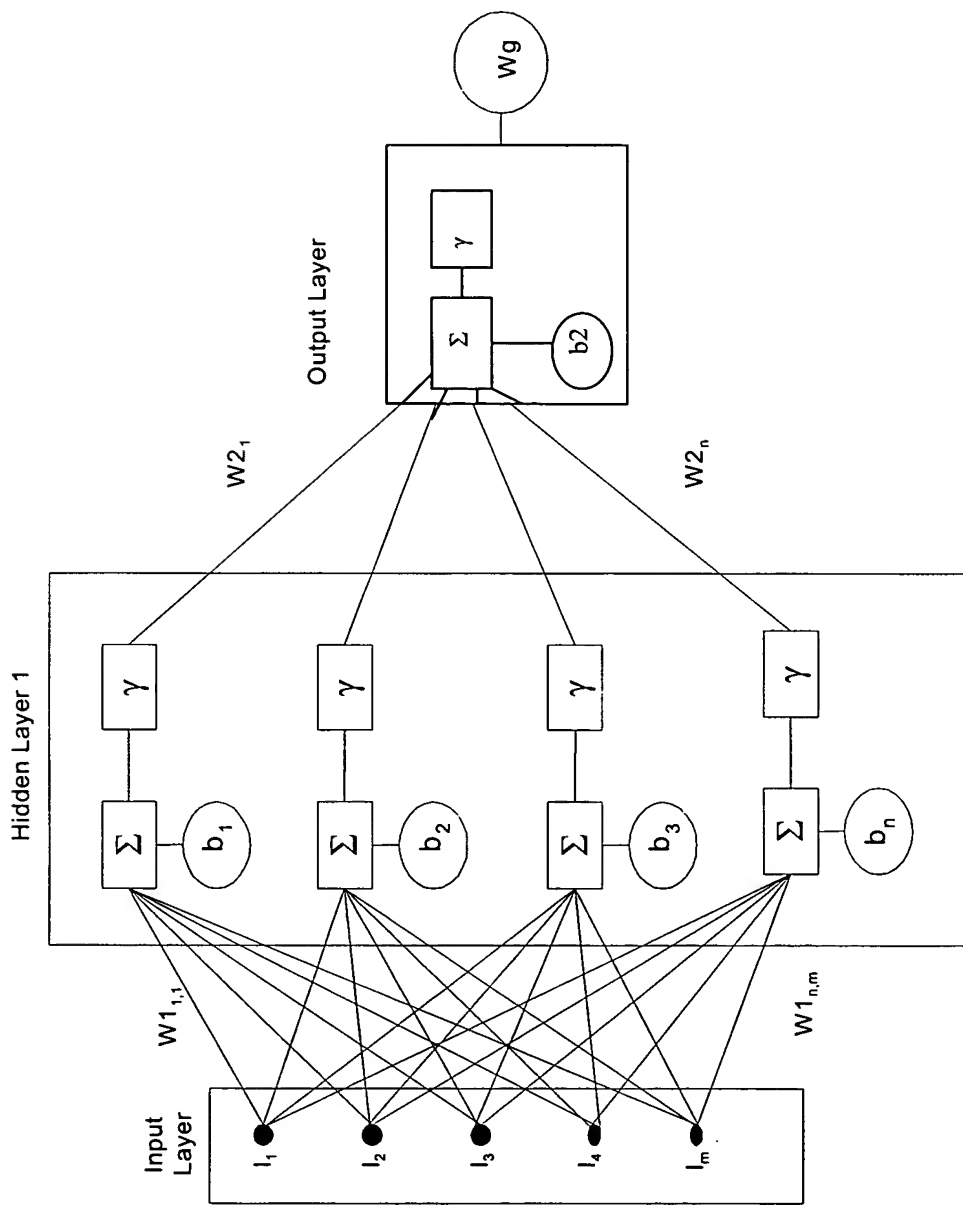


FIGURE 12

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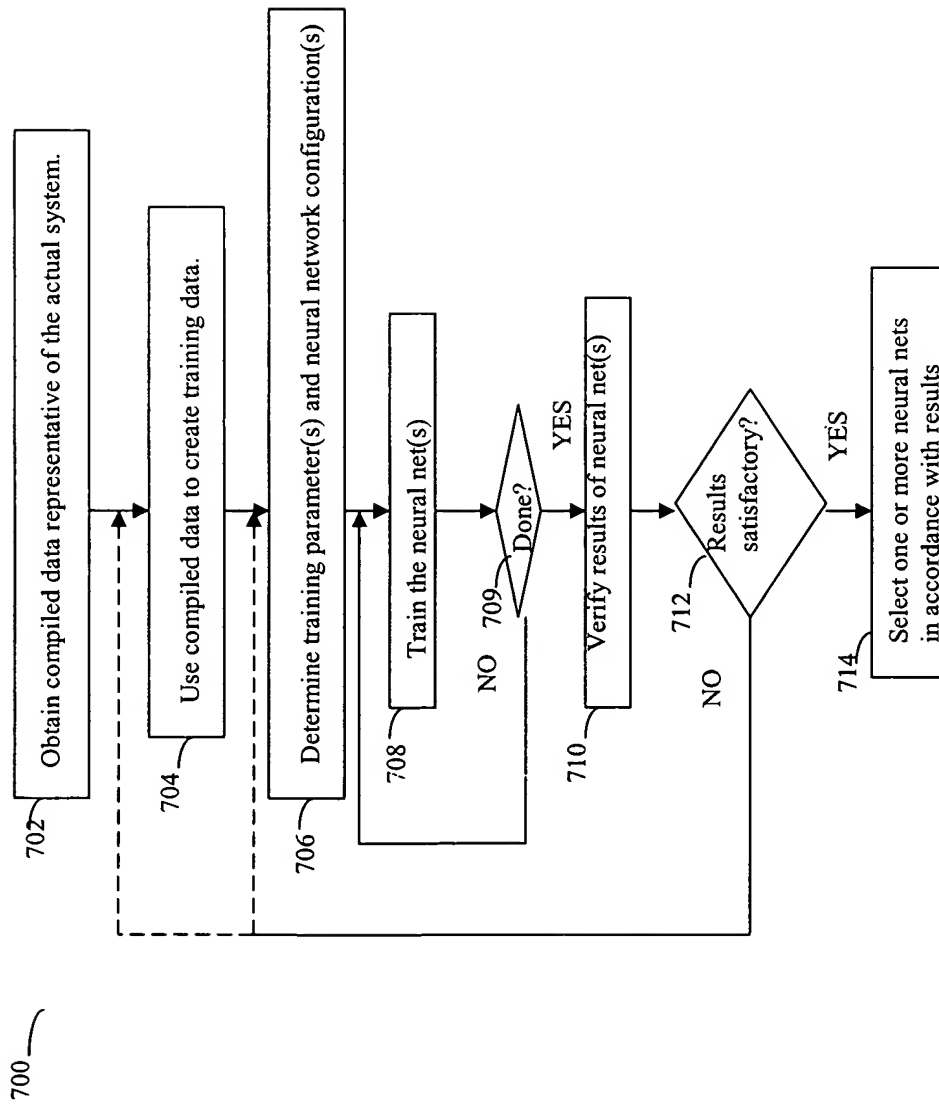


FIGURE 13

Regime— Steady State Hover

Maneuver Name	Hover		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Yaw Rate	<=	2.5	None
Yaw Rate	>=	-2.5	None
Rate of Climb	>=	-200	None
Rate of Climb	<=	200	None
Pitch Attitude	<	10	None
Roll Attitude	<=	3	None
Roll Attitude	>=	-6	None
Drift Velocity	>=	-7	None
Drift Velocity	<=	7	None
Ground Speed	>=	-7	None
Ground Speed	<=	7	None
Calibrated Airspeed	<=	38	5
Control Reversal Flag	=	0	None

FIGURE 14

Regime— Steady State Forward Flight

Maneuver Name	Forward Flight		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>=	-10	None
Roll Attitude	<=	10	None
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Sideslip	<=	.05	None
Sideslip	>=	-.05	None
Pitch Attitude	<=	10	None
Pitch Attitude	>=	-10	None
Yaw Rate	>=	-5	None
Yaw Rate	<=	5	None
Calibrated Airspeed	>	38	5
Control Reversal Flag	=	0	None

FIGURE 15

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Regime - Turn

Maneuver Name	Turn		
Category	Transient		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	<	-10	3
*Roll Attitude	>	10	3
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Calibrated Airspeed	>	38	2

FIGURE 16

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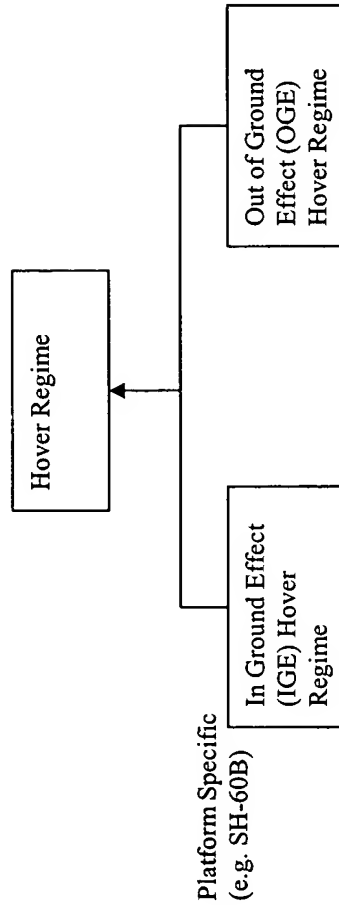


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Regime 1 - Level Flight, up to $0.2 V_H$

Description: Straight and level flight at close to 1.0 G conditions, airspeed less than $0.2 V_H$

Maneuver Name	Level Flight, $0.2 V_H$			
Category	Steady State			
Type	Specific			
Parameter	Operator	Threshold	Hysteresis	
Landing Flag	=	False	None	
Takeoff Flag	=	False	None	
WOW	=	False	None	
Roll Attitude	>=	-10	None	
Roll Attitude	<=	10	None	
Rate of Climb	>=	-500	None	
Rate of Climb	<=	500	None	
Sideslip	<=	.05	None	
Sideslip	>=	-.05	None	
Pitch Attitude	<=	10	None	
Pitch Attitude	>=	-10	None	
Yaw Rate	>=	-5	None	
Yaw Rate	<=	5	None	
VH Fraction	<=	0.2	0.01	
Corrected Load Factor	>=	0.85	None	
Corrected Load Factor	<=	1.18	None	
Calibrated Airspeed	>	38	5	
Control Reversal Flag	=	0	None	

FIGURE 18

Regime 2 - Level Flight, 0.4 V_H

Description: Straight and level flight at close to 1.0 G conditions, airspeed from 0.2 V_H to 0.4 V_H .

Maneuver Name	Level Flight, 0.4 V_H		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>=	-10	None
Roll Attitude	<=	10	None
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Sideslip	<=	.05	None
Sideslip	>=	-.05	None
Pitch Attitude	<=	10	None
Pitch Attitude	>=	-10	None
Yaw Rate	>=	-5	None
Yaw Rate	<=	5	None
VH Fraction	>	0.2	0.01
VH Fraction	<=	0.4	0.01
Corrected Load Factor	>=	0.85	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	5
Control Reversal Flag	=	0	None

FIGURE 19

Regime 3 - Level Flight, $0.5 V_H$

Description: Straight and level flight at close to 1.0 G conditions, airspeed from $0.4 V_H$ to $0.5 V_H$

Maneuver Name	Level Flight, $0.5 V_H$			
Category	Steady State			
Type	Specific			
Parameter	Operator	Threshold	Hysteresis	
Landing Flag	=	False	None	
Takeoff Flag	=	False	None	
WOW	=	False	None	
Roll Attitude	>=	-10	None	
Roll Attitude	<=	10	None	
Rate of Climb	>=	-500	None	
Rate of Climb	<=	500	None	
Sideslip	<=	.05	None	
Sideslip	>=	-.05	None	
Pitch Attitude	<=	10	None	
Pitch Attitude	>=	-10	None	
Yaw Rate	>=	-5	None	
Yaw Rate	<=	5	None	
VH Fraction	>	0.4	0.01	
VH Fraction	<=	0.5	0.01	
Corrected Load Factor	>=	0.85	None	
Corrected Load Factor	<=	1.18	None	
Calibrated Airspeed	>	38	5	
Control Reversal Flag	=	0	None	

FIGURE 20

Regime 4 - Level Flight, 0.6 V_H

Description: Straight and level flight at close to 1.0 G conditions, airspeed from 0.5 V_H to 0.6 V_H .

Maneuver Name	Level Flight, 0.6 V_H		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>=	-10	None
Roll Attitude	<=	10	None
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Sideslip	<=	.05	None
Sideslip	>=	-.05	None
Pitch Attitude	<=	10	None
Pitch Attitude	>=	-10	None
Yaw Rate	>=	-5	None
Yaw Rate	<=	5	None
VH Fraction	>	0.5	0.01
VH Fraction	<=	0.6	0.01
Corrected Load Factor	>=	0.85	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	5
Control Reversal Flag	=	0	None

FIGURE 21

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Regime 5 - Level Flight, $0.7 V_H$

Description: Straight and level flight at close to 1.0 G conditions, airspeed from $0.6 V_H$ to $0.7 V_H$.

Maneuver Name	Level Flight, $0.7 V_H$		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>=	-10	None
Roll Attitude	<=	10	None
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Sideslip	<=	.05	None
Sideslip	>=	-.05	None
Pitch Attitude	<=	10	None
Pitch Attitude	>=	-10	None
Yaw Rate	>=	-5	None
Yaw Rate	<=	5	None
VH Fraction	>	0.6	0.01
VH Fraction	<=	0.7	0.01
Corrected Load Factor	>=	0.85	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	5
Control Reversal Flag	=	0	None

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Regime 6 - Level Flight, 0.8 V_H

Description: Straight and level flight at close to 1.0 G conditions, airspeed from 0.7 V_H to 0.8 V_H .

Maneuver Name	Level Flight, 0.8 V_H		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>=	-10	None
Roll Attitude	<=	10	None
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Sideslip	<=	.05	None
Sideslip	>=	-.05	None
Pitch Attitude	<=	10	None
Pitch Attitude	>=	-10	None
Yaw Rate	>=	-5	None
Yaw Rate	<=	5	None
VH Fraction	>	0.7	0.01
VH Fraction	<=	0.8	0.01
Corrected Load Factor	>=	0.85	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	5
Control Reversal Flag	=	0	None

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Regime 7 - Level Flight, $0.9 V_H$

Description: Straight and level flight at close to 1.0 G conditions, airspeed from $0.8 V_H$ to $0.9 V_H$.

Maneuver Name	Level Flight, $0.9 V_H$		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>=	-10	None
Roll Attitude	<=	10	None
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Sideslip	<=	.05	None
Sideslip	>=	-.05	None
Pitch Attitude	<=	10	None
Pitch Attitude	>=	-10	None
Yaw Rate	>=	-5	None
Yaw Rate	<=	5	None
VH Fraction	>	0.8	0.01
VH Fraction	<=	0.9	0.01
Corrected Load Factor	>=	0.85	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	5
Control Reversal Flag	=	0	None

FIGURE 24

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Regime 8 - Level Flight, 1.0 V_H

Description: Straight flight at close to 1.0 G conditions, airspeed from 0.9 V_H to 1.0 V_H.

Maneuver Name	Level Flight, 1.0 V _H		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>=	-10	None
Roll Attitude	<=	10	None
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Sideslip	<=	.05	None
Sideslip	>=	-.05	None
Pitch Attitude	<=	10	None
Pitch Attitude	>=	-10	None
Yaw Rate	>=	-5	None
Yaw Rate	<=	5	None
VH Fraction	>	0.9	0.01
VH Fraction	<=	1.0	0.01
Corrected Load Factor	>=	0.85	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	5
Control Reversal Flag	=	0	None

FIGURE 25

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Regime 9 - Level Flight, 1.15 V_H

Description: Straight flight, and in a slight dive, at close to 1.0 G conditions, airspeed from 1.0 V_H to 1.15 V_H .

Maneuver Name	Level Flight, 1.15 V_H		
Category	Steady State		
Type	Specific		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>=	-10	None
Roll Attitude	<=	10	None
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Sideslip	<=	.05	None
Sideslip	>=	-.05	None
Yaw Rate	>=	-5	None
Yaw Rate	<=	5	None
VH Fraction	>	1.0	0.01
VH Fraction	<=	1.15	0.01
Corrected Load Factor	>=	0.85	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	5
Control Reversal Flag	=	0	None

FIGURE 26

Regime 10 - Level Flight, $> 1.15 V_H$

Description: Straight flight, and in a slight dive, at close to 1.0 G conditions, airspeed greater than $1.15 V_H$.

Maneuver Name	Level Flight, $> 1.15 V_H$			
Category	Steady State			
Type	Specific			
Parameter	Operator	Threshold	Hysteresis	
Landing Flag	=	False	None	
Takeoff Flag	=	False	None	
WOW	=	False	None	
Roll Attitude	$>=$	-10	None	
Roll Attitude	$<=$	10	None	
Rate of Climb	$>=$	-500	None	
Rate of Climb	$<=$	500	None	
Sideslip	$<=$.05	None	
Sideslip	$>=$	-.05	None	
Yaw Rate	$>=$	-5	None	
Yaw Rate	$<=$	5	None	
VH Fraction	$>$	1.15	0.01	
Corrected Load Factor	$>=$	0.85	None	
Corrected Load Factor	$<=$	1.18	None	
Calibrated Airspeed	$>$	38	5	
Control Reversal Flag	=	0	None	

FIGURE 27

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Regime 133 – 137 Level Left Turn

Description: Left turn while in level flight

Maneuver Name	Level Left Turn		
Category	Transient		
Type	Generic		
Number of Sub Regimes	5		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	<	-10	3
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	2

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Sub-regime definitions: Level left turn

Regime No.	Description	Prorate 1 AOB
133	20° AOB Level Left Turn, 10° to 20° AOB	2
134	30° AOB Level Left Turn, 20° to 35° AOB	3
135	45° AOB Level Left Turn, 35° to 50° AOB	4
136	60° AOB Level Left Turn, 50° to 65° AOB	5
137	> 60° AOB Level Left Turn, > 65° AOB	6

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FIGURE 28

Regime 138 - 142 Level Right Turn

Description: Right turn while in level flight

Maneuver Name	Level Right Turn		
Category	Transient		
Type	Generic		
Number of Sub Regimes	5		
Parameter	Operator	Threshold	Hysteresis
Landing Flag	=	False	None
Takeoff Flag	=	False	None
WOW	=	False	None
Roll Attitude	>	10	3
Rate of Climb	>=	-500	None
Rate of Climb	<=	500	None
Corrected Load Factor	<=	1.18	None
Calibrated Airspeed	>	38	2

Sub-regime definitions: Level Right turn

Regime No.	Description	Prorate 1 AOB
138	20° AOB Level Right Turn, 10° to 20° AOB	2
139	30° AOB Level Right Turn, 10° to 35° AOB	3
140	45° AOB Level Right Turn, 35° to 50° AOB	4
141	60° AOB Level Right Turn, 50° to 65° AOB	5
142	> 60° AOB Level Right Turn, > 65° AOB	6

FIGURE 29

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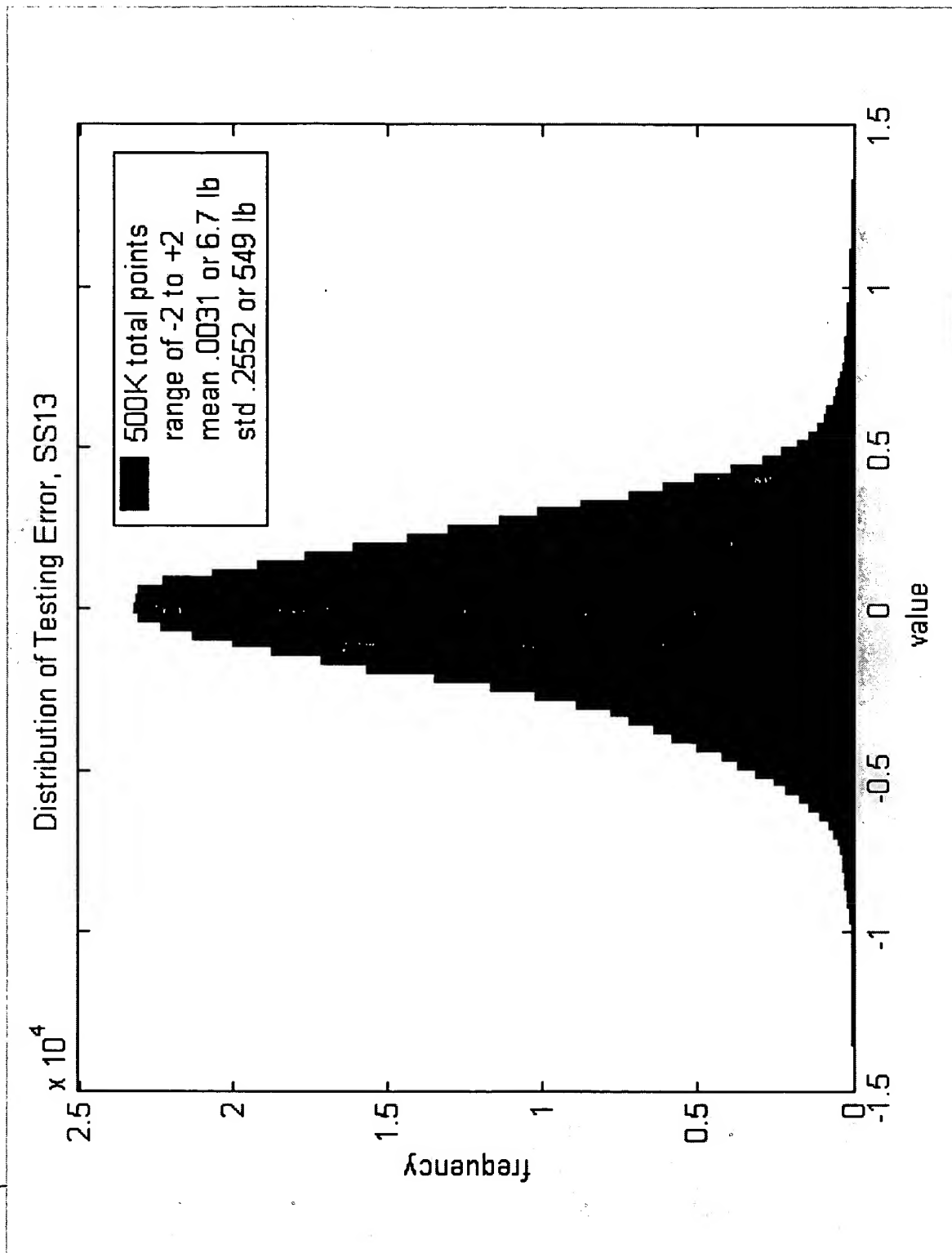


FIGURE 30

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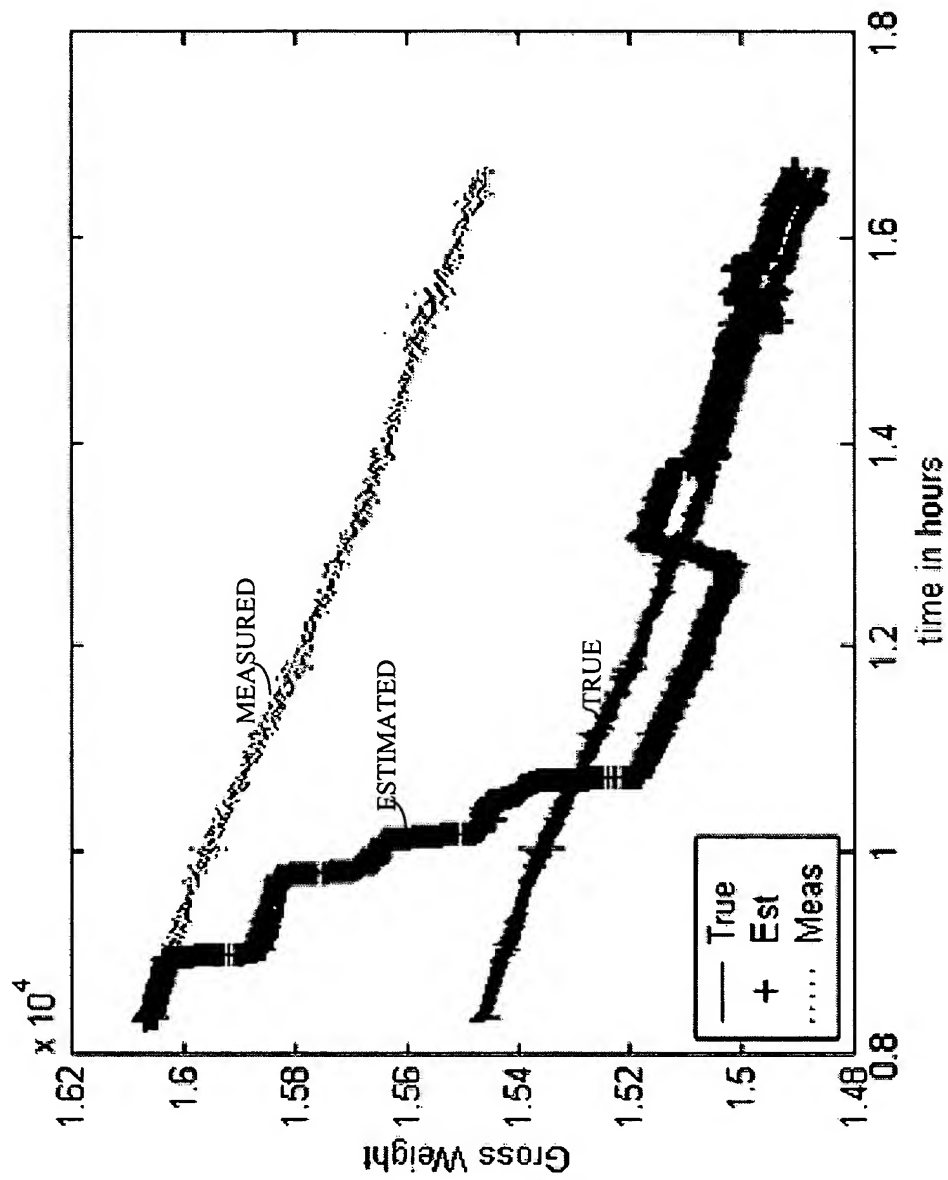


FIGURE 31

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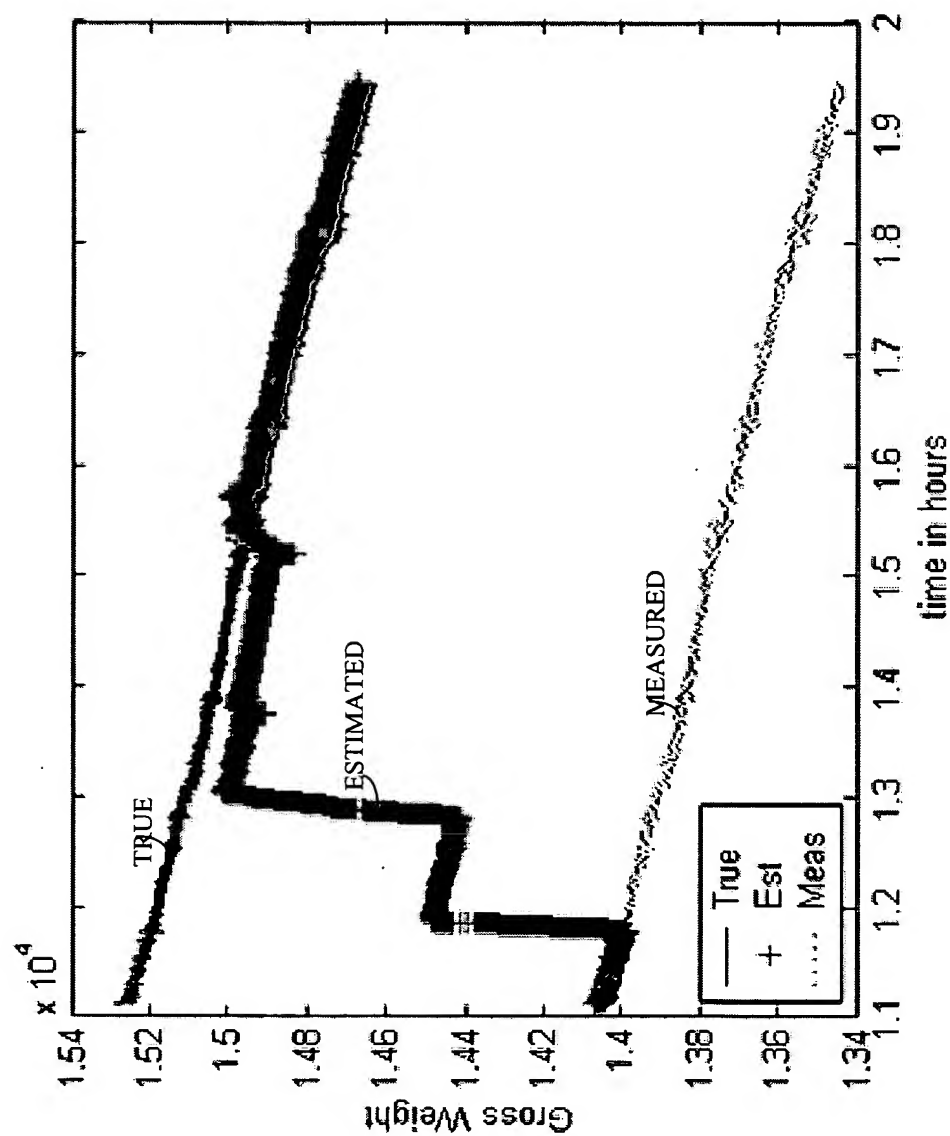


FIGURE 32

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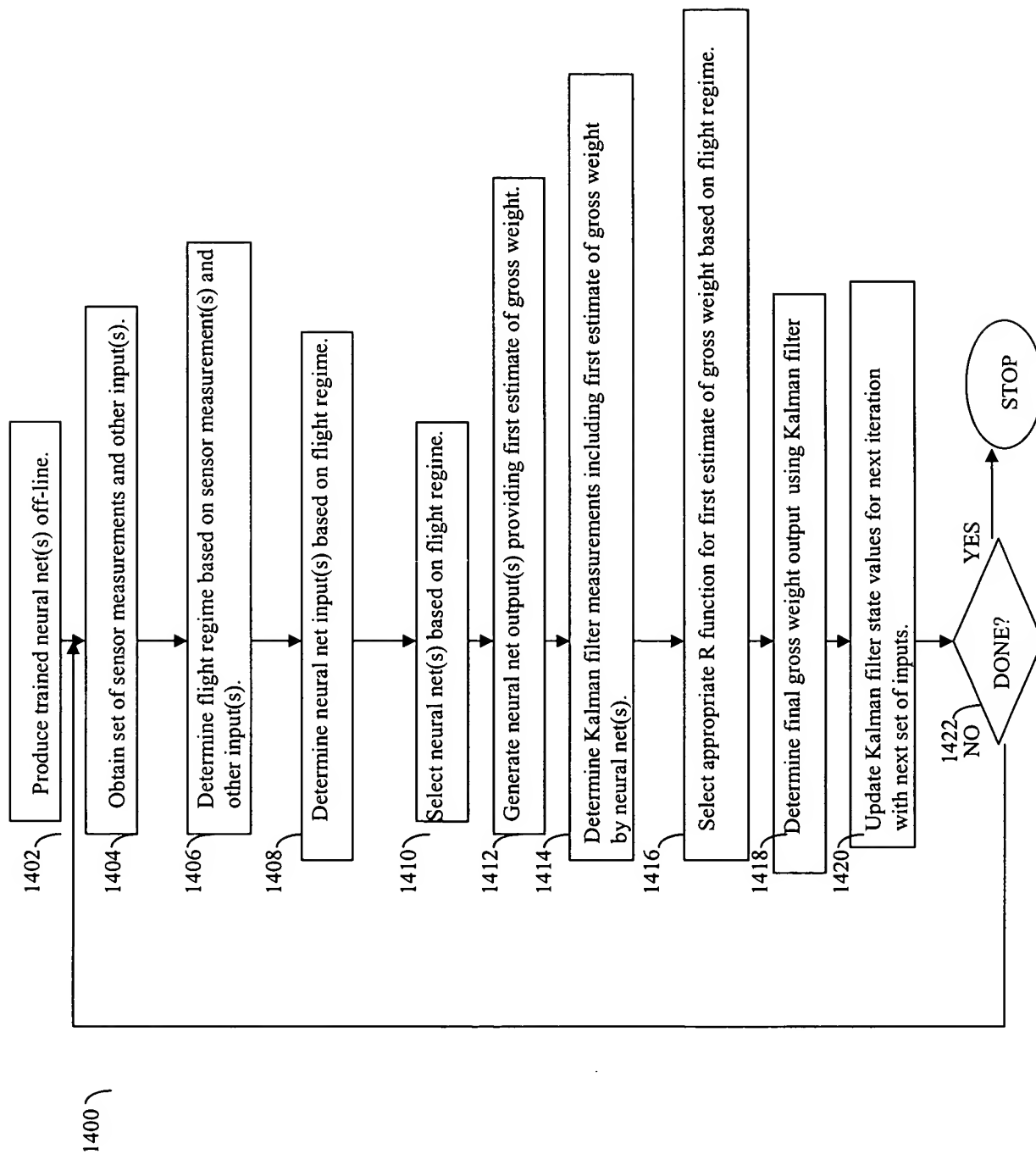


FIGURE 33